



## Evolution of dental concepts

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### Abstract

A major goal of dental treatment is to give a natural and esthetic appearance to the teeth as the patient's desires and needs. The understanding of dental esthetics and dental treatment modalities to achieve dental esthetics have advanced remarkably in the past few years. The newer innovations in the dental techniques, diagnostic technologies, newer materials for restorative treatment, newer advancements in orthodontic treatment, and the latest developments in endodontic treatment have escalated dentistry to a new level. These topics are covered in this review article.

**Keywords:** dental concepts, treatment, dental esthetics, patient's

### Introduction

Dental Treatment has come a long way in the past few decades with advances in the fields of biomaterials for diagnosis of caries, restoration materials, root canal obturation materials, treatment techniques, prosthesis with implant therapy, endodontic treatment, orthodontic treatment, and oral surgical methods as well as 3D printed splint therapy. A sizeable portion of dental advancements have been in the terms of consideration with esthetic dentistry. Esthetic dentistry spans all different fields of dentistry. The major reason for patients seeking orthodontic treatment is esthetics, pain, and function<sup>[1, 2]</sup>. Dentistry was developed as a separate field from medicine with a contribution from pioneers such as Pierre Fauchard. The first wave of dental advances had been on newer materials and techniques for performing dental procedures. As progress occurred, more research was performed in preventive measures in dentistry<sup>[3]</sup>. Since the beginning of 2000s, dental field has seen a tremendous innovation, and progress in technology. With the help of digital innovations and the bonding material advances, more tools are available to the dentists currently for the optimal restoration of teeth in an efficient manner.

### Perception of teeth and esthetics

Facial and dental esthetics play a role in determining the personal status of the patients. In addition, it may also have impact on the person's social life and peer evaluation<sup>[4]</sup>. The self-perception of the patient is also affected largely by the dental and facial esthetics. When individuals with unesthetic teeth are evaluated, it is found that the self-esteem and well-being in such patients is negatively affected<sup>[5]</sup>. Thus, health teeth and attractive smile is important for the psychological perspective. It is necessary to understand that each individual has a different type of teeth, different types of dental problems, be it related to function, esthetics, or pain<sup>[6-8]</sup>. Thus, each individual needs to be diagnosed by a qualified dental professional, and appropriate treatment be rendered to treat the teeth to an optimal occlusion.

### Esthetic Considerations of Tooth Shape

The arrangement, proportion, shape, and color of teeth have been identified in normal individuals with good occlusion and esthetic smile<sup>[9]</sup>. These findings provide an understanding to the normal development of teeth as intended by nature. The initial observations made by authors were subjective to an extent, which were in the later years followed by the objective results by conducting research in large populations. The keys of smile attractiveness and esthetics were explained by Goldstein in 1969<sup>[10]</sup>. Another consideration for esthetics is the midline – the relation of dental midline to facial midline. If the deviation is too high, then the dental arrangement is perceived to be unesthetic<sup>[11]</sup>.

### Incisor Exposure

In 1984, the amount of exposure of incisors on smiling observed and were found to be an important factor in determining the smile esthetics<sup>[12]</sup>. Normally, 80 to 100 percentage of maxillary incisors are visible on smiling. When a higher extent of the teeth are visible, then it is known as high smile line<sup>[13]</sup>. In contrast, a lower amount of visibility of the teeth on smile is known as low smile line. Another parameter that plays a role in the smile esthetics, is the curve of the anterior teeth and how it follows the contour of the lower lip known as the smile arc. In 2014, Nold tried to provide a universal concept for anterior tooth shape selection<sup>[14]</sup>. However, it has been reported that the shape of the teeth, and the surface morphology and texture can vary a lot among individuals<sup>[15]</sup>.

### Shape of Teeth

In the earlier times it was hypothesized that the shape of human face and teeth shape are related to each other<sup>[16]</sup>. However, in recent years, with the advent of 3-dimensional (3D) dental-scans and facial-scans, it has been found that such a correlation does not really exist and the shape of teeth and the shape of the face are not significantly related to each other<sup>[17]</sup>. In recent years, emphasis has been placed on the utilization of 3D technology to identify the ideal inclination of maxillary incisors as they influence the esthetics of the patients<sup>[18]</sup>. Also, 3D technology has been

used in identifying the skeletal maturation of patients with cervical maturation assessment <sup>[19]</sup>.

### Dental Imaging

Dental Imaging in the earlier years was performed with periapical radiography and bitewing radiographs for the identification of caries, loss of bone, periodontal lesions, periapical radiolucency, and other conditions <sup>[20]</sup>. The first major change in the evolution of dental imaging was in the terms of digital imaging. Instead of films being used for dental imaging in the earlier times, digital imaging used phosphor charge-coupled device (CCD) or complementary metal oxide semiconductor (CMOS) technology <sup>[21]</sup>. Another major change in the evolution of dental imaging was the advent of 3D imaging. The dental world has shown a wide acceptance of the 3D radiographs such as cone beam computed tomography (CBCT) in recent years owing to its advantages <sup>[22]</sup>. It has been shown that a major advantage of CBCT is that it does not lead to inaccurate measurements with head positioning errors as is seen in 2D radiographs (CVMI). Artificial Intelligence for the identification of radiographic findings has been evaluated and has been a major development in dental imaging in recent years <sup>[23]</sup>.

### Restorative Treatment

The traditional approach for carious lesions has been to remove the caries mechanically and put a restoration cement or composite to fill the cavity. The recent evolution in restorative field has been the remineralization of the carious lesions <sup>[24]</sup>. Remineralization of caries occurs naturally due to the chemicals in saliva. In addition, fluoride can be used for increasing the remineralization process. Newer therapies have been developed which contain the different compounds such as calcium, phosphate, stannous fluoride, xylitol, etc. in different ratios <sup>[25-28]</sup>. The main goal with all these therapies is to increase the remineralization of the carious lesions.

### Orthodontic Treatment

A major change in the evolution of orthodontic treatment has been the development of orthodontic mini-implants <sup>[28]</sup>. Orthodontic mini-implants have provided the orthodontists with an ability to treat malocclusion that were difficult to treat without surgery. Mini-implant supported expansion (MARPE) can be undertaken in late adolescents in place of surgery to expand the narrow maxillary arch <sup>[29]</sup>. Traditionally, the maxillary expansion has been performed bilaterally in all cases with crossbite, be it unilateral or bilateral crossbite <sup>[30]</sup>. Recently, it has been shown that unilateral crossbite can be corrected by using an innovative design with mini-implant known as U-MARPE which expands maxillary unilaterally <sup>[31]</sup>. Another major change in orthodontic treatment is the use of mini-implant for class III treatment. With the help of mini-implants, class III malocclusion can be treated with intermaxillary elastics to move maxilla forward <sup>[32]</sup>. This can help to treat patients with class III malocclusion non-surgically when indicated. It has been shown that orthodontic treatment with MARPE does not affect the TMJ negatively <sup>[33]</sup>.

### Endodontic Treatment

Endodontic lesions occur due to the microorganisms penetrating the tooth structures into the pulp giving rise to a dental infection. The treatment for such lesions is to remove

the microorganism and sterile the pulp canal of the teeth. The traditional treatment of such lesions has involved the preparation of the root canal with instruments and removing the pulp. However, if all the bacteria are not removed, then they may persist in the canal and the infection is not cured. Thus, the evolution in endodontic treatment has focused on anti-microbial therapies that can be used with root canal preparation to enhance the elimination of all bacteria to ensure a sterile environment <sup>[34]</sup>. The application of nanoparticles to anti-bacterial formulations used in endodontic treatment has been a major advancement in this field <sup>[35]</sup>. Additionally, the therapies such as photodynamic therapy and photon-induced photoacoustic streaming have also been used.

### Conclusion

Achieving optimal dental and facial esthetics are a goal of all dental fields. In the past few decades, the utilization of digital radiography, and 3D radiography and 3D facial scans have revolutionized the understanding of dental and smile esthetics. This accompanies with the innovation in the dental treatment modalities have led to an increased emphasis on esthetics by dentists. Such advancements in the evolution of dental concepts have benefitted the patients at large as they obtain better dental esthetics, and function.

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